mass of a seat occupant who is a 95th-percentile adult male:
(1) Lateral: 4g; and
(2) Vertical: 4g.
(d)(1) Other interior fittings shall be attached to the passenger car body with sufficient strength to withstand the following individually applied accelerations acting on the mass of the fitting:
(i) Longitudinal: 8g;
(ii) Lateral: 4g; and
(iii) Vertical: 4g.
(2) Fittings that can be expected to be impacted by a person during a collision, such as tables between facing seats, shall be designed for the mass of the fitting plus the mass of the number of occupants who are 95th-percentile adult males that could be expected to strike the fitting, when the floor of the passenger car decelerates with a triangular crash pulse having a peak of 8g and a duration of 250 milliseconds.
(e) The ultimate strength of the interior fittings and equipment in power car control cabs shall be sufficient to resist without failure loads due to the following individually applied accelerations acting on the mass of the fitting or equipment:
(1) Longitudinal: 12g;
(2) Lateral: 4g; and
(3) Vertical: 4g.
(f) To the extent possible, interior fittings, except seats, shall be recessed or flush-mounted. Corners and sharp edges shall be avoided or otherwise padded.
(g) Energy-absorbent material shall be used to pad surfaces likely to be impacted by occupants during collisions or derailments.
(h) Luggage stowage compartments shall be enclosed, and have an ultimate strength sufficient to resist loads due to the following individually applied accelerations acting on the mass of the luggage that the compartments are designed to accommodate:
(1) Longitudinal: 8g;
(2) Lateral: 4g; and
(3) Vertical: 4g.
(i) If, for purposes of showing compliance with the requirements of this section, the strength of a seat attachment is to be demonstrated through sled testing, the seat structure and seat attachment to the sled that is used in such testing must be representative of the actual seat structure in, and seat attachment to, the rail vehicle subject to the requirements of this section. If the attachment strength of any other interior fitting is to be demonstrated through sled testing, for purposes of showing compliance with the requirements of this section, such testing shall be conducted in a similar manner.

§ 238.437 Emergency communication.

A means of emergency communication throughout a train shall be provided and shall include the following:
(a) Except as further specified, transmission locations at each end of each passenger car, adjacent to the car's end doors, and accessible to both passengers and crewmembers without requiring the use of a tool or other implement. If the passenger car does not exceed 45 feet in length, only one transmission location is required;
(b) Transmission locations that are clearly marked with luminescent material;
(c) Clear and understandable operating instructions at or near each transmission location; and
(d) Back-up power for a minimum period of 90 minutes.

§ 238.439 Doors.

(a) Each passenger car shall have a minimum of two exterior side doors, each door providing a minimum clear opening with dimensions of 30 inches horizontally by 74 inches vertically.

Note: The Americans with Disabilities Act (ADA) Accessibility Specifications for Transportation Vehicles also contain requirements for doorway clearance (See 49 CFR part 38).

(b) Each passenger car shall be equipped with a manual override feature for each powered, exterior side door. Each manual override must be:
(1) Capable of releasing the door to permit it to be opened, without power, from both inside and outside the car;
(2) Located adjacent to the door which it controls; and
(3) Designed and maintained so that a person may readily access and operate the override device from both inside and outside the car without the use of any tool or other implement.
(c) The status of each powered, exterior side door in a passenger car shall be displayed to the crew in the operating cab. If door interlocks are used, the sensors used to detect train motion shall be nominally set to operate at 3 mph.
(d) Each powered, exterior side door in a passenger car shall be connected to an emergency back-up power system.
(e) A railroad may protect a manual override device used to open a powered, exterior door with a cover or a screen capable of removal without requiring the use of a tool or other implement.
(f) A passenger compartment end door (other than a door providing access to the exterior of the trainset) shall be equipped with a kick-out panel, pop-out window, or other similar means of egress in the event the door will not open, or shall be so designed as to pose a negligible probability of becoming inoperable in the event of car body distortion following a collision or derailment.
(g) *Marking and instructions.* [Reserved]

§ 238.441 Emergency roof entrance location.

(a) Each passenger car and power car cab shall have a minimum of one roof hatch emergency entrance location with a minimum opening of 18 inches by 24 inches, or at least one clearly marked structural weak point in the roof having a minimum opening of the same dimensions to provide quick access for properly equipped emergency response personnel.
(b) *Marking and instructions.* [Reserved]

§ 238.443 Headlights.

Each power car shall be equipped with at least two headlights. Each headlight shall produce no less than 200,000 candela. One headlight shall be focused to illuminate a person standing between the rails 800 feet ahead of the power car under clear weather conditions. The other headlight shall be focused to illuminate a person standing between the rails 1500 feet ahead of the power car under clear weather conditions.

§ 238.445 Automated monitoring.

(a) Each passenger train shall be equipped to monitor the performance of the following systems or components:
(1) Reception of cab signals and train control signals;
(2) Truck hunting;
(3) Dynamic brake status;
(4) Friction brake status;
(5) Fire detection systems;
(6) Head end power status;
(7) Alerter or deadman control;
(8) Horn and bell;
(9) Wheel slide;
(10) Tilt system, if so equipped; and
(11) On-board bearing-temperature sensors, if so equipped.
(b) When any such system or component is operating outside of its predetermined safety parameters:
(1) The train operator shall be alerted; and
(2) Immediate corrective action shall be taken, if the system or component defect impairs the train operator's ability to safely operate the train. Immediate corrective action includes limiting the speed of the train.
(c) The monitoring system shall be designed with an automatic self-test feature that notifies the train operator

that the monitoring capability is functioning correctly and alerts the train operator when a system failure occurs.

§ 238.447 Train operator's controls and power car cab layout.

(a) Train operator controls in the power car cab shall be arranged so as to minimize the chance of human error, and be comfortably within view and within easy reach when the operator is seated in the normal train control position.

(b) The train operator's control panel buttons, switches, levers, knobs, and the like shall be distinguishable by sight and by touch.

(c) An alerter shall be provided in the power car cab. If not acknowledged, the alerter shall cause a brake application to stop the train.

(d) Power car cab information displays shall be designed with the following characteristics:

(1) Simplicity and standardization shall be the driving criteria for design of formats for the display of information in the cab;

(2) Essential, safety-critical information shall be displayed as a default condition;

(3) Operator selection shall be required to display other than default information;

(4) Cab or train control signals shall be displayed for the operator; and

(5) Displays shall be readable from the operators's normal position under all lighting conditions.

(e) The power car cab shall be designed so at to permit the crew to have an effective field of view in the forward direction, as well as to the right and left of the direction of travel to observe objects approaching the train from either side. Field-of-view obstructions due to required structural members shall be minimized.

(f) Each seat provided for an employee regularly assigned to occupy a power car cab and any floor-mounted seat in the cab shall be:

(1) Secured to the car body with an attachment having an ultimate strength capable of withstanding the loads due to the following individually applied accelerations acting on the combined mass of the seat and the mass of a seat occupant who is a 95th-percentile adult male:

(i) Longitudinal: 12g;

(ii) Lateral: 4g; and

(iii) Vertical: 4g;

(2) Designed so that all adjustments have the range necessary to accommodate a person ranging from a 5th-percentile adult female to a 95th-percentile adult male, as persons possessing such characteristics are specified, correcting for clothing as appropriate, in any recognized survey after 1958 of weight, height, and other body dimensions of U.S. adults;

(3) Equipped with lumbar support that is adjustable from the seated position;

(4) Equipped with force-assisted, vertical-height adjustment, operated from the seated position;

(5) Equipped with a manually reclining seat back, adjustable from the seated position;

(6) Equipped with an adjustable headrest; and

(7) Equipped with folding, padded armrests.

(g) Sharp edges and corners shall be eliminated from the interior of the power car cab, and interior surfaces of the cab likely to be impacted by an employee during a collision or derailment shall be padded with shock-absorbent material.

BILLING CODE 4910–06–P

Figure 1—to Subpart E

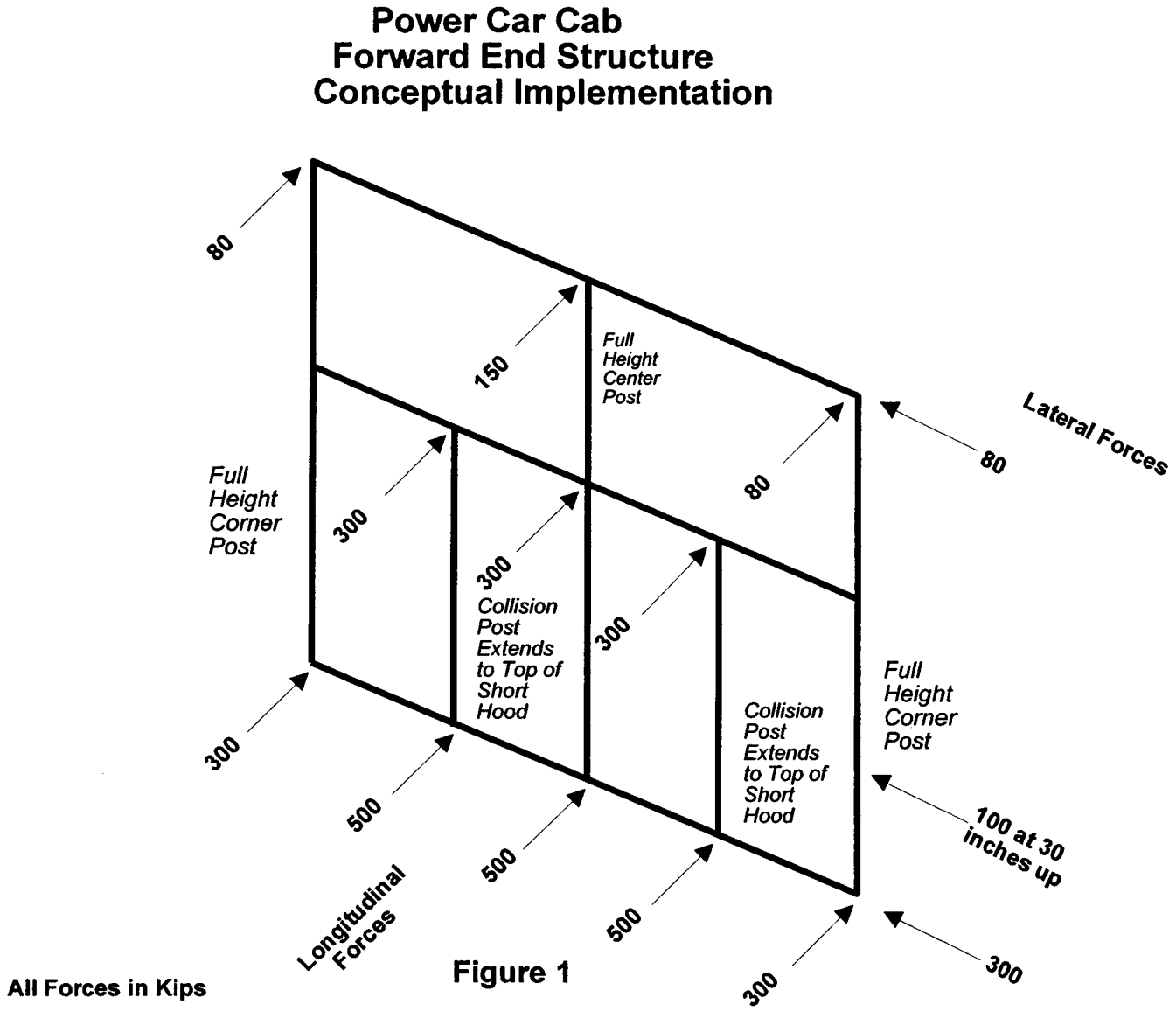

Figure 1

Figure 2—to Subpart E

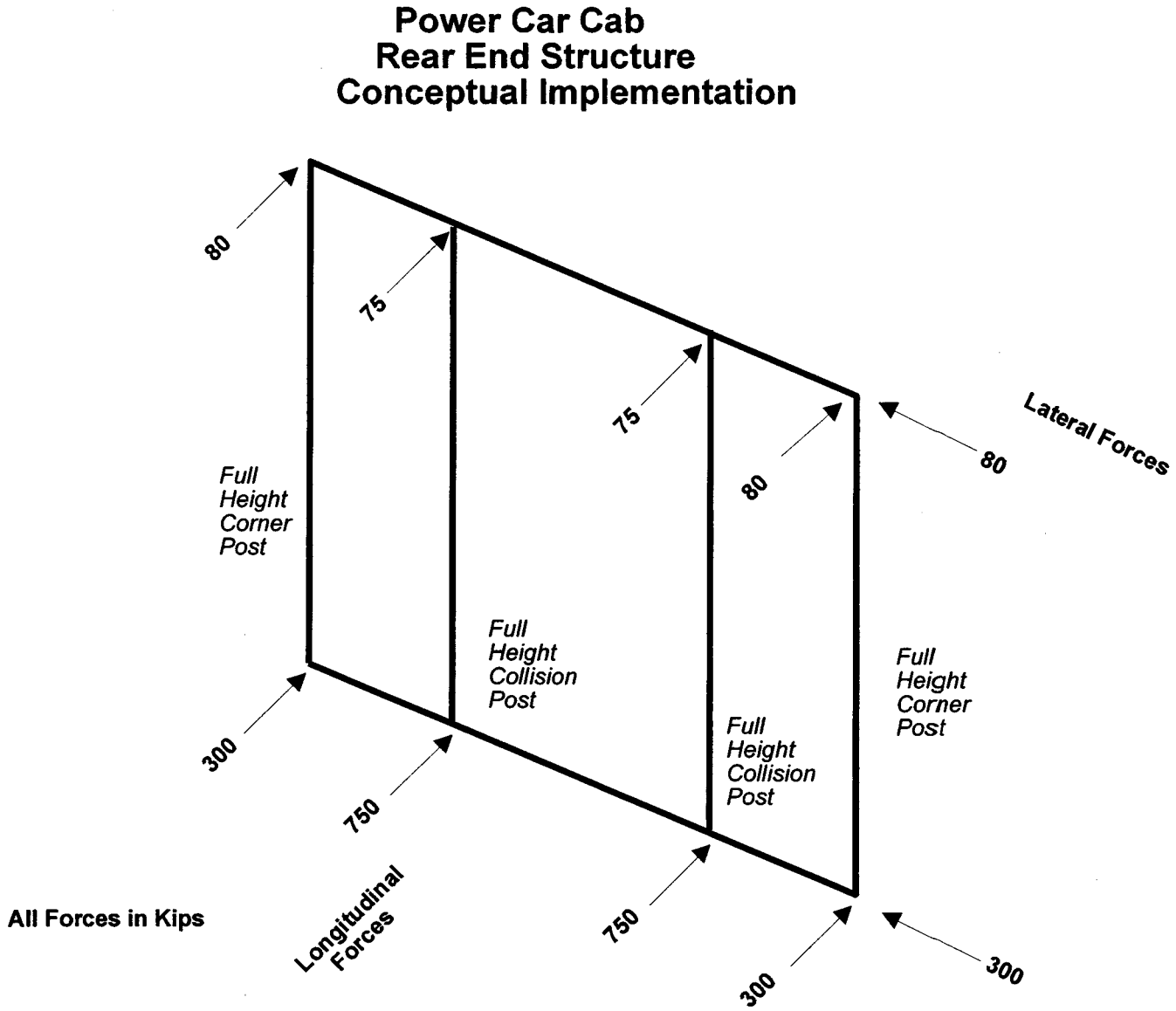

Figure 2

Figure 3—to Subpart E

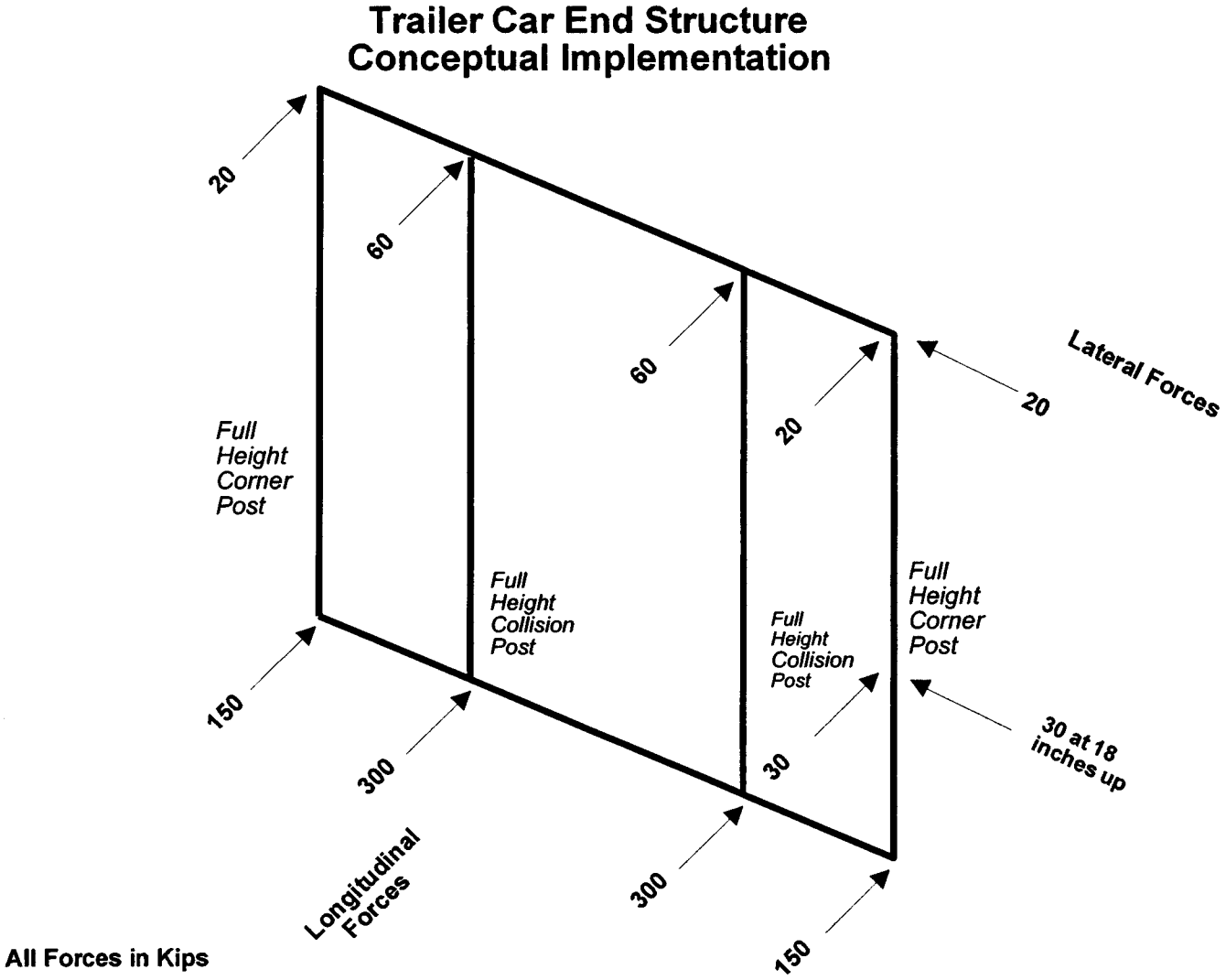

Figure 3

Figure 4—to Subpart E

Trailer Car In-Board Vestibule End Structure Conceptual Implementation

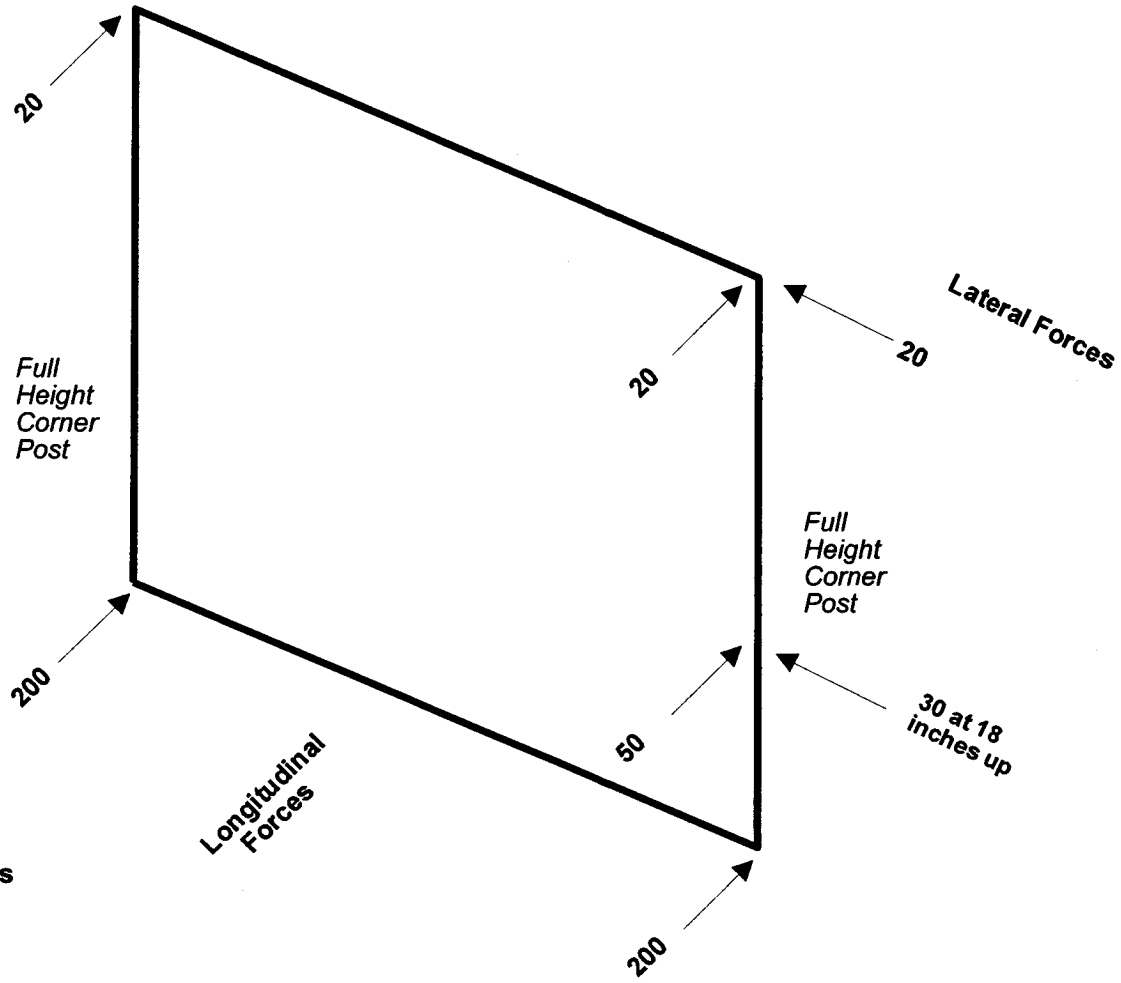

Figure 4

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Subpart F—Inspection, Testing, and Maintenance Requirements for Tier II Passenger Equipment.

§ 238.501 Scope.

This subpart contains inspection, testing, and maintenance requirements for railroad passenger equipment that operates at speeds exceeding 125 mph but not exceeding 150 mph.

§ 238.503 Inspection, testing, and maintenance requirements.

(a) *General.* Under the procedures provided in § 238.505, each railroad shall obtain FRA approval of a written inspection, testing, and maintenance program for Tier II passenger equipment prior to implementation of that program and prior to commencing passenger operations using that equipment. As further specified in this section, the program shall describe in detail the procedures, equipment, and other means necessary for the safe operation of the passenger equipment, including:

(1) Inspection procedures, intervals, and criteria;

(2) Testing procedures and intervals;

(3) Scheduled preventive-maintenance intervals;

(4) Maintenance procedures;

(5) Special testing equipment or measuring devices required to perform inspections, tests, and maintenance; and

(6) The training, qualification, and designation of employees and contractors to perform inspections, tests, and maintenance.

(b) *Compliance.* After the railroad's inspection, testing, and maintenance program is approved by FRA under § 238.505, the railroad shall adopt the program and shall perform—

(1) The inspections and tests of power brakes and other primary brakes as described in the program;

(2) The other inspections and tests described in the program in accordance with the procedures and criteria that the railroad identified as safety-critical; and

(3) The maintenance tasks described in the program in accordance with the procedures and intervals that the railroad identified as safety-critical.

(c) *General safety inspection, testing, and maintenance procedures.* The inspection, testing, and maintenance program under paragraph (a) of this section shall contain the railroad's written procedures to ensure that all systems and components of in service passenger equipment are free of any general condition that endangers the safety of the crew, passengers, or equipment. These procedures shall protect against:

(1) A continuous accumulation of oil or grease;

(2) Improper functioning of a component;

(3) A crack, break, excessive wear, structural defect, or weakness of a component;

(4) A leak;

(5) Use of a component or system under a condition that exceeds that for which the component or system is designed to operate; and

(6) Insecure attachment of a component.

(d) *Specific inspections.* The program under paragraph (a) of this section shall specify that all Tier II passenger equipment shall receive thorough inspections in accordance with the following standards:

(1) Except as provided in paragraph (d)(3) of this section, the equivalent of a Class I brake test contained in § 238.313 shall be conducted prior to a train's departure from an originating terminal and every 1,500 miles or once each calendar day, whichever comes first, that the train remains in continuous service.

(i) Class I equivalent brake tests shall be performed by a qualified maintenance person.

(ii) Except as provided in § 238.15(b), a railroad shall not use or haul a Tier II passenger train in passenger service from a location where a Class I equivalent brake test has been performed, or was required by this part to have been performed, with less than 100 percent operative brakes.

(2) Except as provided in paragraph (d)(3) of this section, a complete exterior and interior mechanical inspection, in accordance with the railroad's inspection program, shall be conducted by a qualified maintenance person at least once during each calendar day the equipment is used in service.

(3) Trains that miss a scheduled Class I brake test or mechanical inspection due to a delay en route may proceed to the point where the Class I brake test or mechanical inspection was scheduled to be performed.

(e) *Movement of trains with power brake defects.* Movement of trains with a power brake defect as defined in § 238.15 (any primary brake defect) shall be governed by § 238.15.

(f) *Movement of trains with other defects.* Movement of a train with a defect other than a power brake defect shall be conducted in accordance with § 238.17, with the following exception: When a failure of the secondary brake on a Tier II passenger train occurs en route, that train may remain in service until its next scheduled calendar day Class I brake test equivalent at a speed no greater than the maximum safe operating speed demonstrated through analysis and testing for braking with the friction brake alone. The brake system shall be restored to 100 percent operation before the train departs that inspection location.

(g) *Maintenance intervals.* The program under paragraph (a) of this section shall include the railroad's initial scheduled maintenance intervals for Tier II equipment based on an analysis completed pursuant to the railroad's safety plan. The maintenance interval of a safety-critical component shall be changed only when justified by accumulated, verifiable operating data and approved by FRA under § 238.505 before the change takes effect.

(h) *Training, qualification, and designation program.* The program under paragraph (a) of this section shall describe the training, qualification, and designation program, as defined in the training program plan under § 238.109, established by the railroad to qualify individuals to inspect, test, and maintain the equipment.

(1) If the railroad deems it safety-critical, then only qualified individuals shall inspect, test, and maintain the equipment.

(2) Knowledge of the procedures described in paragraph (a) of this section shall be required to qualify an employee or contractor to perform an inspection, testing, or maintenance task under this part.

(i) *Standard procedures.* The program under paragraph (a) of this section shall include the railroad's written standard procedures for performing all safety-critical equipment inspection, testing, maintenance, and repair tasks necessary to ensure the safe and proper operation of the equipment. The inspection, testing, and maintenance program required by this section is not intended to address and should not include procedures to address employee working conditions that arise in the course of conducting the inspections, tests, and maintenance set forth in the program. When reviewing the railroad's program, FRA does not intend to review any portion of the program that relates to employee working conditions.

(j) *Annual review.* The inspection, testing, and maintenance program required by this section shall be reviewed by the railroad annually.

(k) *Quality control program.* Each railroad shall establish an inspection, testing, and maintenance quality control program enforced by railroad or contractor supervisors to reasonably ensure that inspections, tests, and maintenance are performed in accordance with Federal safety standards and the procedures established by the railroad.

(l) *Identification of safety-critical items.* In the program under paragraph (a) of this section, the railroad shall identify all inspection and testing procedures and criteria as well as all maintenance intervals that the railroad deems to be safety-critical.

§ 238.505 Program approval procedure.

(a) *Submission.* Not less than 90 days prior to commencing passenger operations using Tier II passenger equipment, each railroad to which this subpart applies shall submit for approval an inspection, testing, and maintenance program for that equipment meeting the requirements of this subpart with the Associate Administrator for Safety, Federal Railroad Administration, 1120 Vermont Ave, Mail Stop 25, Washington, D.C. 20590. If a railroad seeks to amend an approved program, the railroad shall file with FRA's Associate Administrator for Safety a petition for approval of such amendment not less than 60 days prior to the proposed effective date of the amendment. A program responsive to the requirements of this subpart or any amendment to the program shall not be implemented prior to FRA approval.

(1) Each program or amendment under § 238.503 shall contain:

(i) The information prescribed in § 238.503 for such program or amendment;

(ii) The name, title, address, and telephone number of the primary person to be contacted with regard to review of the program or amendment; and

(iii) A statement affirming that the railroad has served a copy of the program or amendment on designated representatives of railroad employees, together with a list of the names and addresses of persons served.

(2) Each railroad shall serve a copy of each submission to FRA on designated representatives of railroad employees responsible for the equipment's operation, inspection, testing, and maintenance under this subpart.

(b) *Comment.* Not later than 45 days from the date of filing the program or amendment, any person may comment on the program or amendment.

(1) Each comment shall set forth specifically the basis upon which it is made, and contain a concise statement of the interest of the commenter in the proceeding.

(2) Three copies of each comment shall be submitted to the Associate Administrator for Safety, Federal Railroad Administration, 1120 Vermont Ave., Mail Stop 25, Washington, D.C. 20590.

(3) The commenter shall certify that a copy of the comment was served on the railroad.

(c) *Approval.*

(1) Within 60 days of receipt of each initial inspection, testing, and maintenance program, FRA will conduct a formal review of the program. FRA will then notify the primary railroad contact person and the designated employee representatives in writing whether the inspection, testing, and maintenance program is approved and, if not approved, the specific points in which the program is deficient. If a program is not approved by FRA, the railroad shall amend its program to correct all deficiencies and resubmit its program with the required revisions not later than 45 days prior to commencing passenger operations.

(2) FRA will review each proposed amendment to the program within 45 days of receipt. FRA will then notify the primary railroad contact person and the designated employee representatives in writing whether the proposed amendment has been approved by FRA and, if not approved, the specific points in which the proposed amendment is deficient. The railroad shall correct any deficiencies and file the corrected amendment prior to implementing the amendment.

(3) Following initial approval of a program or amendment, FRA may reopen consideration of the program or amendment for cause stated.

Subpart G—Specific Safety Planning Requirements for Tier II Passenger Equipment

§ 238.601 Scope.

This subpart contains specific safety planning requirements for the operation of Tier II passenger equipment, procurement of Tier II passenger equipment, and the introduction or major upgrade of new technology in existing Tier II passenger equipment that affects a safety system on such equipment.

§ 238.603 Safety planning requirements

(a) Prior to commencing revenue service operation of Tier II passenger equipment, each railroad shall prepare and execute a written plan for the safe operation of such equipment. The plan may be combined with any other plan required under this part. The plan shall be updated at least every 365 days. At a minimum, the plan shall describe the approaches and processes to:

(1) Identify all requirements necessary for the safe operation of the equipment in its operating environment;

(2) Identify all known or potential hazards to the safe operation of the equipment;

(3) Eliminate or reduce the risk posed by each hazard identified to an acceptable level using MIL–STD–882C as a guide or an alternative formal, safety methodology; and

(4) Impose operational limitations, as necessary, on the operation of the equipment if the equipment cannot meet safety requirements.

(b) For the procurement of Tier II passenger equipment, and for each major upgrade or introduction of new technology in existing Tier II passenger equipment that affects a safety system on such equipment, each railroad shall prepare and execute a written safety plan. The plan may be combined with any other plan required under this part. The plan shall describe the approaches and processes to:

(1) Identify all safety requirements governing the design of the passenger equipment and its supporting systems;

(2) Evaluate the total system, including hardware, software, testing, and support activities, to identify known or potential safety hazards over the life cycle of the equipment;

(3) Identify safety issues during design reviews;

(4) Eliminate or reduce the risk posed by each hazard identified to an acceptable level using MIL–STD–882C as a guide or an alternative, formal safety methodology;

(5) Monitor the progress in resolving safety issues, reducing hazards, and meeting safety requirements;

(6) Develop a program of testing or analysis, or both, to demonstrate that safety requirements have been met; and

(7) Impose operational limitations, as necessary, on the operation of the equipment if the equipment cannot meet safety requirements.

(c) Each railroad shall maintain sufficient documentation to demonstrate how the operation and design of its Tier II passenger equipment complies with safety requirements or, as appropriate, addresses safety requirements under paragraphs (a)(4) and (b)(7) of this section. Each railroad shall maintain sufficient documentation to track how safety issues are raised and resolved.

(d) Each railroad shall make available to FRA for inspection and copying upon request each safety plan required by this section and any documentation required pursuant to such plan.

APPENDIX A TO PART 238—SCHEDULE OF CIVIL PENALTIES[1]

Section	Violation	Willful violation
SUBPART A—GENERAL		
238.15 Movement of power brake defects:		
(b) Improper movement from Class I or IA brake test	5,000	7,500
(c) Improper movement of en route defect	2,500	5,000
(2), (3) Insufficient tag or record	1,000	2,000
(4) Failure to determine percent operative brake	2,500	5,000
(d) Failure to follow operating restrictions	5,000	7,500
(e) Failure to follow restrictions for inoperative front or rear unit	2,500	5,000
238.17 Movement of other than power brake defects: [1]		
(c)(4), (5) Insufficient tag or record	1,000	2,000
(d) Failure to inspect or improper use of roller bearings	2,500	5,000
(e) Improper movement of defective safety appliances	(1)	
238.19 Reporting and tracking defective equipment:		
(a) Failure to have reporting or tracking system	7,500	11,000
(b) Failure to retain records	2,000	4,000
(c) Failure to make records available	1,000	2,000
(d) Failure to list power brake repair points	2,000	4,000
SUBPART B—SAFETY PLANNING AND GENERAL REQUIREMENTS		
238.103 Fire protection plan/fire safety:		
(a) Failure to use proper materials	5,000	7,500
(b) Improper certification	1,000	2,000
(c) Failure to consider fire safety on new equipment	5,000	7,500
(d) Failure to perform fire safety analysis	5,000	7,500
(e) Failure to develop, adopt or comply with procedures	5,000	7,500
238.105 Train hardware and software safety:		
(a), (b), (c) Failure to develop and maintain hardware and software safety program	7,500	11,000
(d) Failure to include required design features in hardware and software	5,000	7,500
(e) Failure to comply with hardware and software safety program	5,000	7,500
238.107 Inspection, testing, and maintenance plan:		
(b) Failure to develop plan	7,500	11,000
(b)(1)–(5) Failure of plan to address specific item	3,000	6,000
(d) Failure to conduct annual review	5,000	7,500
238.109 Training, qualification, and designation program:		
(a) Failure to develop or adopt program	7,500	11,000
(b)(1)–(4) Failure of plan to address specific item	3,000	6,000
(b)(5)–(12) Failure to comply with specific required provision of the program	5,000	7,500
(b)(13) Failure to maintain adequate records	2,500	5,000
238.111 Pre-revenue service acceptance testing plan:		
(a) Failure to properly test previously used equipment	7,500	11,000
(b)(1) Failure to develop plan	7,500	11,000
(b)(2) Failure to submit plan to FRA	5,000	7,500
(b)(3) Failure to comply with plan	5,000	7,500
(b)(4) Failure to document results of testing	5,000	7,500
(b)(5) Failure to correct safety deficiencies or impose operating limits	5,000	7,500
(b)(6) Failure to maintain records	3,000	6,000
(b)(7) Failure to obtain FRA approval	5,000	7,500
238.113 Emergency window exits	2,500	5,000
238.115 Emergency lighting	2,500	5,000
238.117 Protection against personal injury	2,500	5,000
238.119 Rim-stamped straight plate wheels	2,500	5,000
SUBPART C—SPECIFIC REQUIREMENTS FOR TIER I EQUIPMENT		
238.203 Static end strength	2,500	5,000
238.205 Anti-climbing mechanism	2,500	5,000
238.207 Link between coupling mechanism and car body	2,500	5,000
238.209 Forward-facing end structure of locomotives	2,500	5,000
238.211 Collision posts	2,500	5,000
238.213 Corner posts	2,500	5,000
238.215 Rollover strength	2,500	5,000
238.217 Side structure	2,500	5,000
238.219 Truck-to-car-body attachment	2,500	5,000
238.221 Glazing	2,500	5,000
238.223 Fuel tanks	2,500	5,000
238.225 Electrical System	2,500	5,000
238.227 Suspension system	2,500	5,000
238.231 Brake system: (a)–(g), (i)–(m)	2,500	5,000
(h) Hand or parking brake missing or inoperative	5,000	5,000
238.233 Interior fittings and surfaces	2,500	7,500
238.235 Doors	2,500	5,000
238.237 Automated monitoring	2,500	5,000

APPENDIX A TO PART 238—SCHEDULE OF CIVIL PENALTIES[1]—Continued

Section	Violation	Willful violation
SUBPART D—INSPECTION, TESTING, AND MAINTENANCE REQUIREMENTS FOR TIER I EQUIPMENT		
238.303 Exterior mechanical inspection of passenger equipment:		
(a)(1) Failure to perform mechanical inspection	[1] 2,000	4,000
(a)(2) Failure to inspect secondary brake system	2,500	5,000
(b) Failure to perform inspection on car added to train	[1] 2,000	4,000
(c) Failure to utilize properly qualified personnel	2,000	4,000
(e)(1) Products of combustion not released outside cab	2,500	5,000
(e)(2) Battery not vented or gassing excessively	2,500	5,000
(e)(3) Coupler not in proper condition	2,500	5,000
(e)(4) No device under drawbar pins or connection pins	2,500	5,000
(e)(5) Suspension system and spring rigging not in proper condition	2,500	5,000
(e)(6) Truck not in proper condition	2,500	5,000
(e)(7) Side bearing not in proper condition	2,500	5,000
(e)(8) Wheel not in proper condition:		
(i), (iv) Flat spot(s) and shelled spot(s):		
(A) One spot 2½″ or more but less than 3″ in length	2,500	5,000
(B) One spot 3″ or more in length	5,000	7,500
(C) Two adjoining spots each of which is 2″ or more in length but less than 2½″ in length	2,500	5,000
(D) Two adjoining spots each of which are at least 2″ in length, if either spot is 2½″ or more in length	5,000	7,500
(ii) Gouge or chip in flange:		
(A) More than 1½″ but less than 1⅝″ in length; and more than ½″ but less than ⅝″ in width	2,500	5,000
(B) 1⅝″ or more in length and ⅝″ or more in width	5,000	7,500
(iii) Broken rim	5,000	7,500
(v) Seam in tread	2,500	5,000
(vi) Flange thickness of:	2,500	5,000
(A) ⅞″ or less but more than 13⁄16″.		
(B) 13⁄16″ or less	5,000	7,500
(vii) Tread worn hollow	2,500	5,000
(viii) Flange height of:		
(A) 1½″ or greater but less than 1⅝″	2,500	5,000
(B) 1⅝″ or more	5,000	7,500
(ix) Rim thickness:		
(A) Less than 1″	2,500	5,000
(B) 15⁄16″ or less	5,000	7,500
(x) Crack or break in flange, tread, rim, plate, or hub:		
(A) Crack of less than 1″	2,500	5,000
(B) Crack of 1″ or more	5,000	7,500
(C) Break	5,000	7,500
(xi) Loose wheel	5,000	7,500
(xii) Welded wheel	5,000	7,500
(e)(10) Improper grounding or insulation	5,000	7,500
(e)(11) Jumpers or cable connections not in proper condition	2,500	5,000
(e)(12) Door or cover plate not properly marked	2,500	5,000
(e)(13) Buffer plate not properly placed	2,500	5,000
(e)(14) Diaphragm not properly placed or aligned	2,500	5,000
(e)(15) Secondary braking system not in operating mode or contains known defect	2,500	5,000
(g) Record of inspection:		
(1), (4) Failure to maintain record of inspection	5,000	4,000
(2) Record contains insufficient information	1,000	2,000
238.305 Interior mechanical inspection of passenger cars:		
(a) Failure to perform inspection	[1] 1,000	2,000
(b) Failure to utilize properly qualified personnel	1,000	2,000
(c)(1) Failure to protect against personal injury	2,500	5,000
(c)(2) Emergency brake valve not stenciled or marked	2,500	5,000
(c)(3) Door or cover plates not properly marked	2,500	5,000
(c)(4) Trap door unsafe or improperly secured	2,500	5,000
(c)(5) Doors not safely operate as intended	2,500	5,000
(i)–(iv) Condition for operating defective door not satisfied	2,000	4,000
(c)(6) Safety signage not in place or legible	1,000	2,000
(c)(7) Vestibule steps not illuminated	2,000	4,000
(c)(8) Access to manual door release not in place	2,000	4,000
(c)(9) Emergency equipment not in place	1,000	2,000
(e) Record of inspection:		
(1), (4) Failure to maintain record of inspection	2,000	4,000
(2) Record contains insufficient information	1,000	1,000
238.307 Periodic mechanical inspection of passenger cars and unpowered vehicles:		
(a) Failure to perform periodic mechanical inspection	[1] 2,500	5,000
(b) Failure to utilize properly qualified personnel	2,500	5,000
(c)(1) Floors not free of condition that creates hazard	2,500	5,000
(c)(2) Emergency lighting not operational	2,500	5,000
(c)(3) Switches not in proper condition	2,500	5,000

APPENDIX A TO PART 238—SCHEDULE OF CIVIL PENALTIES[1]—Continued

Section	Violation	Willful violation
(c)(4) Truck not equipped with securing arrangement	2,500	5,000
(c)(5) Truck center casting cracked or broken	5,000	7,500
(c)(6) Roller bearings:		
(i) Overheated	5,000	7,500
(ii) Cap screw loose or missing	2,500	5,000
(iii) Cap screw lock broken or missing	1,000	2,000
(iv) Seal loose, damaged, or leaks lubricant	2,500	5,000
(c)(7) General conditions endangering crew, passengers	2,500	5,000
(d)(1) Seat or seat attachment broken or loose	2,500	5,000
(d)(2) Luggage rack broken or loose	2,500	5,000
(d)(3) Bed, bunks, or restraints broken or loose	2,500	5,000
(d)(4) Emergency window exit not properly operate	2,500	5,000
(d)(5) Coupler not in proper condition	2,500	5,000
(f)(1) Record of inspection:		
(i) Failure to maintain record of inspection	2,000	4,000
(ii) Record contains insufficient information	1,000	2,000
238.309 Periodic brake equipment maintenance:		
(b) Failure to perform on MU locomotive	2,500	5,000
(c) Failure to perform on conventional locomotive	2,500	5,000
(d) Failure to perform on passenger coaches or other unpowered vehicle	2,500	5,000
(e) Failure to perform on cab car	2,500	5,000
(f) Record of periodic maintenance:		
(1), (2) Failure to maintain record or stencil	2,000	4,000
238.311 Single car tests:		
(a) Failure to test in accord with required procedure	2,500	5,000
(b) Failure to utilize properly qualified personnel	2,500	5,000
(c), (e) Failure to perform single car test	2,500	5,000
(f) Improper movement of car for testing	2,000	4,000
(g) Failure to test after repair or replacement of component	2,000	4,000
238.313 Class I brake test:		
(a) Failure to perform on commuter or short distance intercity passenger train	[1] 10,000	15,000
(b) Failure to perform on long-distance intercity passenger train	[1] 10,000	15,000
(c) Failure to perform on cars added to passenger train	[1] 5,000	7,500
(d) Failure to utilized properly qualified personnel	5,000	7,500
(f) Passenger train used from Class I brake test with less than 100% operative brakes	5,000	7,500
(g) Partial failure to perform inspection on a passenger train	5,000	7,500
(h) Failure to maintain record	2,000	4,000
238.315 Class IA brake test:		
(a) Failure to perform inspection	[1] 5,000	7,500
(d) Failure to utilize properly qualified personnel	2,500	5,000
(e) Passenger train used from Class IA brake test with improper percentage of operative brakes	5,000	7,500
(f) Partial failure to perform inspection on passenger train	2,500	5,000
238.317 Class II brake test:		
(a) Failure to perform inspection	[1] 2,500	5,000
(b) Failure to utilize properly qualified personnel	2,500	5,000
(c) Improper use of defective equipment from Class II brake test	2,500	5,000
238.319 Running brake tests:		
(a), (b) Failure to perform test	2,000	4,000
SUBPART E—SPECIFIC REQUIREMENTS FOR TIER II PASSENGER EQUIPMENT		
238.403 Crash energy management	2,500	5,000
238.405 Longitudinal static compressive strength	2,500	5,000
238.407 Anti-climbing mechanism	2,500	5,000
238.409 Forward end structures of power car cabs:		
(a) Center collision post	2,500	5,000
(b) Side collision posts	2,500	5,000
(c) Corner posts	2,500	5,000
(d) Skin	2,500	5,000
238.411 Rear end structures of power car cabs:		
(a) Corner posts	2,500	5,000
(b) Collision posts	2,500	5,000
238.413 End structures of trailer cars	2,500	5,000
238.415 Rollover strength	2,500	5,000
238.417 Side loads	2,500	5,000
238.419 Truck-to-car-body and truck component attachment	2,500	5,000
238.421 Glazing:		
(b) End-facing exterior glazing	2,500	5,000
(c) Alternate glazing requirements	2,500	5,000
(d) Glazing securement	1,000	2,000
(e) Stenciling	2,500	5,000
238.423 Fuel tanks:		

APPENDIX A TO PART 238—SCHEDULE OF CIVIL PENALTIES[1]—Continued

Section	Violation	Willful violation
(a) External fuel tanks	2,500	5,000
(b) Internal fuel tanks	2,500	5,000
238.425 Electrical system:		
(a) Circuit protection	2,500	5,000
(b) Main battery system	2,500	5,000
(c) Power dissipation resistors	2,500	5,000
(d) Electromagnetic interference and compatibility	2,500	5,000
238.427 Suspension system:		
(a) General design	2,500	5,000
(b) Lateral accelerations	2,500	5,000
(c) Hunting Oscillations	2,500	5,000
(d) Ride vibrations	2,500	5,000
(e) Overheat sensors	2,500	5,000
238.429 Safety Appliances:		
(a) Couplers	5,000	7,500
(b) Hand/parking brakes	5,000	7,500
(d) Handrail and handhold missing	2,500	5,000
(d)(1)–(8) Handrail or handhold improper design	2,500	5,000
(e) Sill step missing	5,000	7,500
(e)(1)–(11) Sill step improper design	2,500	5,000
(g) Optional safety appliances	2,500	5,000
238.431 Brake system	2,500	5,000
238.433 Draft System	2,500	5,000
238.435 Interior fittings and surfaces	2,500	5,000
238.437 Emergency communication	2,500	5,000
238.439 Doors:		
(a) Exterior side doors	2,500	5,000
(b) Manual override feature	2,500	5,000
(c) Notification to crew of door status	2,500	5,000
(d) Emergency back-up power	2,500	5,000
(f) End door kick-out panel or pop-out window	2,500	5,000
(g) Marking and instructions	[Reserved]	
238.441 Emergency roof hatch entrance location	2,500	5,000
238.443 Headlights	2,500	5,000
238.445 Automated monitoring	2,500	5,000
238.447 Train operator's controls and power car cab layout	2,500	5,000
SUBPART F—INSPECTION, TESTING, AND MAINTENANCE REQUIREMENTS FOR TIER II PASSENGER EQUIPMENT		
238.503 Inspection, testing, and maintenance requirements:		
(a) Failure to develop inspection, testing, and maintenance program or obtain FRA approval	10,000	15,000
(b) Failure to comply with provisions of the program	5,000	7,500
(c) Failure to ensure equipment free of conditions which endanger safety of crew, passengers, or equipment	2,500	5,000
(d) Specific safety inspections:		
(1)(i) Failure to perform Class I brake test or equivalent	10,000	15,000
(1)(ii) Partial failure to perform Class I brake test or equivalent	5,000	7,500
(2)(i) Failure to perform exterior mechanical inspection	[1] 2,000	4,000
(2)(ii) Failure to perform interior mechanical inspection	[1] 1,000	2,000
(g) Failure to perform scheduled maintenance as required in program	2,500	5,000
(h) Failure to comply with training, qualification and designation program	5,000	7,500
(i) Failure to develop or comply with standard procedures for performing inspection, tests, and maintenance	2,500	5,000
(j) Failure to conduct annual review	5,000	7,500
(k) Failure to establish or utilize quality control program	5,000	7,500
SUBPART G—SPECIFIC SAFETY PLANNING REQUIREMENTS FOR TIER II PASSENGER EQUIPMENT		
238.603 Safety plan:		
(a) Failure to develop safety operating plan	7,500	11,000
(b) Failure to develop procurement plan	7,500	11,000
(1)–(7) Failure to develop portion of plan	2,500	5,000

APPENDIX A TO PART 238—SCHEDULE OF CIVIL PENALTIES[1]—Continued

Section	Violation	Willful violation
(c) Failure to maintain documentation	2,500	5,000

[1] A penalty may be assessed against an individual only for a willful violation Generally when two or more violations of these regulations are discovered with respect to a single unit of passenger equipment that is placed or continued in service by a railroad, the appropriate penalties set forth above are aggregated up to a maximum of $10,000 per day. However, failure to perform, with respect to a particular unit of passenger equipment, any of the inspections and tests required under subparts D and F of this part will be treated as a violation separate and distinct from, and in addition to, any substantive violative conditions found on that unit of passenger equipment. Moreover, the Administrator reserves the right to assess a penalty of up to $22,000 for any violation where circumstances warrant. *See* 49 CFR part 209, appendix A. Failure to observe any condition for movement of defective equipment set forth in § 238.17 will deprive the railroad of the benefit of the movement-for-repair provision and make the railroad and any responsible individuals liable for penalty under the particular regulatory section(s) concerning the substantive defect(s) present on the unit of passenger equipment at the time of movement Failure to observe any condition for the movement of passenger equipment containing defective safety appliances, other than power brakes, set forth in § 238.17(e) will deprive the railroad of the movement-for-repair provision and make the railroad and any responsible individuals liable for penalty under the particular regulatory section(s) contained in part 231 of this chapter or § 238.429 concerning the substantive defective condition. The penalties listed for failure to perform the exterior and interior mechanical inspections and tests required under § 238.303 and § 238.305 may be assessed for each unit of passenger equipment contained in a train that is not properly inspected Whereas, the penalties listed for failure to perform the brake inspections and tests under § 238.313 through § 238.319 may be assessed for each train that is not properly inspected.

Appendix B to Part 238—Test Methods and Performance Criteria for the Flammability and Smoke Emission Characteristics of Materials Used in Passenger Cars and Locomotive Cabs

This appendix provides the test methods and performance criteria for the flammability and smoke emission characteristics of materials used in passenger cars and locomotive cabs, in accordance with the requirements of § 238.103.

(a) *Incorporation by reference.* Certain documents are incorporated by reference into this appendix with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. You may inspect a copy of each document during normal business hours at the Federal Railroad Administration, Docket Clerk, 1120 Vermont Ave., N.W., Suite 7000 or at the Office of the Federal Register, 800 North Capitol Street, N.W., Suite 700, Washington, D.C. The documents incorporated by reference into this appendix and the sources from which you may obtain these documents are listed below:

(1) American Society for Testing and Materials (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428–2959.

(i) ASTM C 1166–91, Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories.

(ii) ASTM D 2724–87, Standard Test Methods for Bonded, Fused, and Laminated Apparel Fabrics.

(iii) ASTM D 3574–95, Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams.

(iv) ASTM D 3675–95, Standard Test Method for Surface Flammability of Flexible Cellular Materials Using a Radiant Heat Energy Source.

(v) ASTM E 119–98, Standard Test Methods for Fire Tests of Building Construction and Materials.

(vi) ASTM E 162–98, Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

(vii) ASTM E 648–97, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

(viii) ASTM E 662–97, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

(ix) ASTM E 1354–97, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter.

(x) ASTM E 1537–98, Standard Test Method for Fire Testing of Upholstered Seating Furniture.

(2) General Services Administration, Federal Supply Service, Specification Section, 470 E. L'Enfant Plaza, S.W., Suite 8100, Washington, D.C., 20407. FED–STD–191A—Textile Test Method 5830, Leaching Resistance of Cloth; Standard Method (July 20, 1978).

(3) National Electrical Manufacturers Association (NEMA), 1300 North 17th St, Suite 1847, Rosslyn, VA 22209. NEMA WC 3/ICEA S–19–1981, Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (part 6, section 19, paragraph 6), Revision 1, Sixth Edition (February, 1994).

(4) State of California, Department of Consumer Affairs, Bureau of Home Furnishings and Thermal Insulation, 3485 Orange Grove Avenue, North Highlands, CA 95660. California Technical Bulletin 133, Flammability Test Procedure for Seating Furniture for Use in Public Occupancies (January, 1991).

(5) The Institute of Electrical and Electronics Engineers, Inc. (IEEE), 345 East 47th Street, New York, New York 10017. ANSI/IEEE Std. 383–1974, IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations (1974).

(6) Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062–2096.

(i) UL 44, Standard for Safety for Thermoset-Insulated Wires and Cables, 14th edition (January 27, 1997).

(ii) UL 83, Standard for Safety for Thermoplastic-Insulated Wires and Cables, 12th edition (September 29, 1998).

(b) *Definitions.* As used in this appendix—

Critical radiant flux (C.R.F.) means, as defined in ASTM E 648, a measure of the behavior of horizontally-mounted floor covering systems exposed to a flaming ignition source in a graded radiant heat energy environment in a test chamber.

Flame spread Index (I_s) means, as defined in ASTM E 162, a factor derived from the rate of progress of the flame front (F_s) and the rate of heat liberation by the material under test (Q), such that $I_s = F_s \times Q$.

Flaming dripping means periodic dripping of flaming material from the site of material burning or material installation.

Flaming running means continuous flaming material leaving the site of material burning or material installation.

Peak heat release rate ($\dot{q}''_{max}$) means, as defined in ASTM E 1354, the maximum heat release rate per unit (kW/m^2).

Specific optical density (D_s) means, as defined in ASTM E 662, the optical density measured over unit path length within a chamber of unit volume, produced from a specimen of unit surface area, that is irradiated by a heat flux of 2.5 watts/cm^2 for a specified period of time.

Surface flammability means the rate at which flames will travel along surfaces.

Time to ignition (t_{ig}) means, as defined in ASTM E 1354, the time in seconds (s) to sustained flaming.

Time to ignition/Peak heat release rate ($t_{ig}/\dot{q}''_{max}$) means the ratio of a given material's time to ignition to its peak (maximum) heat release rate as measured in the Cone Calorimeter (ASTM E 1354) under the stipulated exposure conditions.

(c) *Required test methods and performance criteria.* The materials used in locomotive cabs and passenger cars shall be tested according to the methods and meet the performance criteria set forth in the following table and notes:

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Test Procedures and Performance Criteria for the Flammability and Smoke Emission Characteristics of Materials Used in Passenger Cars and Locomotive Cabs

CATEGORY	FUNCTION OF MATERIAL	TEST METHOD	PERFORMANCE CRITERIA
Cushions, Mattresses	All [1, 2, 3, 4, 5, 6, 7, 8]	ASTM D 3675-95	$I_S \leq 25$
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 175
Fabrics	All [1, 2, 3, 6, 7, 8]	14 CFR 25, Appendix F, Part I, (vertical test)	Flame time $\leq$ 10 seconds Burn length $\leq$ 6 inches
		ASTM E 662-97	D_S (4.0) $\leq$ 200
Vehicle Components [9, 10, 11, 12]	All except flexible cellular foams, floor coverings, light transmitting plastics, and items addressed under other specific categories [1, 2]	ASTM E 162-98	$I_S \leq 35$
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 200
	Flexible cellular foams [1, 2]	ASTM D 3675-95	$I_S \leq 25$
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 175
	Floor covering [13, 14]	ASTM E 648-97	C.R.F. $\geq$ 5 kW/m^2
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 200
	Light transmitting plastics [2, 15]	ASTM E 162-98	$I_S \leq 100$
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 200
	Elastomers [16]	ASTM C 1166-91	Pass
		ASTM E 662-97	D_S (1.5) $\leq$ 100 D_S (4.0) $\leq$ 200
Wire and Cable	Low voltage wire and cable	NEMA WC 3/ ICEA S-19-1981, paragraph 6.19.6; or UL 44 and UL 83 [17]	Pass
		ASTM E 662-97	D_S (4.0) $\leq$ 200 (flaming) D_S (4.0) $\leq$ 75 (non-flaming)
	Power cable	ANSI/IEEE Std 383-1974 [18]	Pass
		ASTM E 662-97	D_S (4.0) $\leq$ 200 (flaming) D_S (4.0) $\leq$ 75 (non-flaming)
Structural Components [19]	Flooring [20], Other [21]	ASTM E 119-98	Pass

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[1] Materials tested for surface flammability shall not exhibit any flaming running or dripping.

[2] The ASTM E 662–97 maximum test limits for smoke emission (specific optical density) shall be measured in either the flaming or non-flaming mode, utilizing the mode which generates the most smoke.

[3] Testing of a complete seat or mattress assembly (including cushions, fabric layers, upholstery) according to ASTM E 1537–98 with application of pass/fail criteria of California Technical Bulletin 133 shall be permitted in lieu of the test methods prescribed herein, provided the assembly component units remain unchanged or new (replacement) assembly components possess equivalent fire performance properties to the original components tested. A fire hazard analysis must also be conducted that considers the operating environment within which the seat or mattress assemblies will be used in relation to the risk of vandalism, puncture, cutting, or other acts which may expose the individual components of the assemblies.

[4] Testing is performed without upholstery.

[5] The surface flammability and smoke emission characteristics shall be demonstrated to be permanent after dynamic testing according to ASTM D 3574–95, Test I_2 (Dynamic Fatigue Test by the Roller Shear at Constant Force) or Test I_3 (Dynamic Fatigue Test by Constant Force Pounding) both using Procedure B.

[6] The surface flammability and smoke emission characteristics shall be demonstrated to be permanent by washing, if appropriate, according to FED–STD–191A Textile Test Method 5830.

[7] The surface flammability and smoke emission characteristics shall be demonstrated to be permanent by dry-cleaning, if appropriate, according to ASTM D 2724–87.

[8] Materials that cannot be washed or dry-cleaned shall be so labeled and shall meet the applicable performance criteria after being cleaned as recommended by the manufacturer.

[9] As a minimum, combustible component materials required to be tested include seat and mattress frames, wall and ceiling panels, seat and toilet shrouds, tray and other tables, partitions, shelves, windscreens, HVAC ducting, thermal and acoustic insulation, exterior plastic components, and interior and exterior box covers.

[10] Materials used to fabricate miscellaneous, discontinuous small parts (such as knobs, rollers, fasteners, clips, grommets, and small electrical parts) that will not contribute materially to fire growth in end use configuration may be exempted from fire and smoke emission performance requirements, provided that the surface area of any individual small part is not ≥16 square inches (100 cm^2) in end use configuration and an appropriate fire hazard analysis is conducted which addresses the location and quantity of the materials used, and the vulnerability of the materials to ignition and contribution of flame spread.

[11] If the surface area of any individual small part is less than 16 square inches (100 cm^2) in end use configuration, materials used to fabricate such small part shall be tested in accordance with ASTM E 1354–97, unless such small part has been shown not to contribute materially to fire growth following an appropriate fire hazard analysis as specified in Note 10. Materials tested in accordance with ASTM E 1354–97 shall meet the performance criteria of $t_{ig}/q_{max} \leq 1.5$. Testing shall be at 50 kW/m^2 applied heat flux.

[12] Assessment of smoke generation by small miscellaneous, discontinuous parts may be made by utilizing the results from the ASTM E1354–97 test procedure conducted in accordance with Note 11, rather than the ASTM E 662–97 test procedure, if an appropriate fire hazard analysis is provided which addresses the location and quantity of the materials used, and the vulnerability of the materials to ignition and contribution of smoke spread.

[13] Carpeting used as a wall or ceiling covering shall be tested as a vehicle component.

[14] Floor covering shall be tested with padding in accordance with ASTM E 648–97, if the padding is used in the actual installation.

[15] For double window glazing, only the interior glazing is required to meet the materials requirements specified herein. (The exterior glazing need not meet these requirements.)

[16] Elastomeric materials used for parts having a surface area ≥16 square inches (100 cm^2) shall be tested in accordance with ASTM C 1166–91. As a minimum, parts required to be tested include window gaskets, door nosing, diaphragms, and roof mats.

[17] Testing shall be conducted in accordance with NEMA WC 3/ICEA S–19–1981, paragraph 6.19.6; or UL 44 for thermosetting wire insulation and UL 83 for thermoplastic wire insulation.

[18] Testing shall be conducted in accordance with ANSI/IEEE Standard 383–1974, section 2.5, with the additional requirement that circuit integrity shall continue for 5 minutes after the start of the test.

[19] Penetrations (ducts, etc.) shall be designed to prevent fire and smoke from entering a vehicle, and representative penetrations shall be included as part of test assemblies.

[20] Structural flooring assemblies shall meet the performance criteria during a nominal test period as determined by the railroad. The nominal test period must be twice the maximum expected time period under normal circumstances for a vehicle to stop completely and safely from its maximum operating speed, plus the time necessary to evacuate all the vehicle's occupants to a safe area. The nominal test period must not be less than 15 minutes. Only one specimen need be tested. A proportional reduction may be made in the dimensions of the specimen, provided the specimen represents a true test of the ability of the structural flooring assembly to perform as a barrier against under-vehicle fires. The fire resistance period required shall be consistent with the safe evacuation of a full load of passengers from the vehicle under worst-case conditions.

[21] Portions of the vehicle body (including equipment carrying portions of a vehicle's roof but not including floors) which separate major ignition sources, energy sources, or sources of fuel-load from vehicle interiors, shall have sufficient fire endurance as determined by a fire hazard analysis acceptable to the railroad which addresses the location and quantity of the materials used, as well as vulnerability of the materials to ignition, flame spread, and smoke generation.

Appendix C to Part 238—Suspension System Safety Performance Standards

This appendix contains the minimum suspension system safety performance standards for Tier II passenger equipment as required by § 238.427. These requirements shall be the basis for evaluating suspension system safety performance until an industry standard acceptable to FRA is developed and approved under the procedures provided in § 238.21.

(a) Passenger equipment suspension systems shall be designed to limit the lateral and vertical forces and lateral to vertical (L/V) ratios, for the time duration required to travel five feet at any operating speed or over any class of track, under all operating conditions as determined by the railroad, as follows:

(1) The maximum single wheel lateral to vertical force (L/V) ratio shall not exceed Nadal's limit as follows:

$$\text{Wheel L/V} \leq \frac{\tan(\delta) - \mu}{1 + \mu \tan(\delta)}$$

where: δ=flange angle (deg).
μ=coefficient of friction of 0.5.

(2) The net axle lateral force shall not exceed 0.5 times the static vertical axle load.

(3) The vertical wheel/rail force shall not be less than or equal to 10 percent of the static vertical wheel load.

(4) The sum of the vertical wheel loads on one side of any truck shall not be less than or equal to 20 percent of the static vertical axle load. This shall include the effect of a crosswind allowance as specified by the railroad for the intended service.

(5) The maximum truck side L/V ratio shall not exceed 0.6.

(6) When stopped on track with a uniform 6-inch superelevation, vertical wheel loads, at all wheels, shall not be less than or equal to 60 percent of the nominal vertical wheel load on level track.

(b) For purposes of this appendix, wheel/rail force measurements shall be processed through a low pass filter having a cut-off frequency of 25 Hz.

Appendix D to Part 238—Requirements for External Fuel Tanks on Tier I Locomotives

The requirements contained in this appendix are intended to address the structural and puncture resistance properties of the locomotive fuel tank to reduce the risk of fuel spillage to acceptable levels under derailment and minor collision conditions.

(a) *Structural strength.*

(1) *Load case 1—minor derailment.* The end plate of the fuel tank shall support a

sudden loading of one-half the weight of the car body at a vertical acceleration of 2g, without exceeding the ultimate strength of the material. The load is assumed to be supported on one rail, within an eight inch band (plus or minus) at a point nominally above the head of the rail, on tangent track. Consideration should be given in the design of the fuel tank to maximize the vertical clearance between the top of the rail and the bottom of the fuel tank.

(2) *Load case 2—jackknifed locomotive.* The fuel tank shall support transversely at the center a sudden loading equivalent to one half the weight of the locomotive at a vertical acceleration of 2g, without exceeding the ultimate strength of the material. The load is assumed to be supported on one rail, distributed between the longitudinal center line and the edge of the tank bottom, with a rail head surface of two inches.

(3) *Load case 3—side impact.* In a side impact collision by an 80,000 pound Gross Vehicle Weight tractor/trailer at the longitudinal center of the fuel tank, the fuel tank shall withstand, without exceeding the ultimate strength, a 200,000 pound load (2.5g) distributed over an area of six inches by forty-eight inches (half the bumper area) at a height of thirty inches above the rail (standard DOT bumper height).

(4) *Load case 4—penetration resistance.* The minimum thickness of the sides, bottom sheet and end plates of the fuel tank shall be equivalent to a 5/16-inch steel plate with a 25,000 pounds-per-square-inch yield strength (where the thickness varies inversely with the square root of yield strength). The lower one third of the end plates shall have the equivalent penetration resistance by the above method of a 3/4-inch steel plate with a 25,000 pounds-per-square-inch yield strength. This may be accomplished by any combination of materials or other mechanical protection.

(b) *Sideswipe.* To minimize fuel tank damage during sideswipes (railroad vehicles and grade crossings), all drain plugs, clean-out ports, inspection covers, sight glasses, gauge openings, etc., must be flush with the tank surface or adequately protected to avoid catching foreign objects or breakage. All seams must be protected or flush to avoid catching foreign objects.

(c) *Spill controls.* Vents and fills shall be designed to avert spillage of fuel in the event of a roll over.

Appendix E to Part 238—General Principles of Reliability-Based Maintenance Programs

(a) Any maintenance program has the following four basic objectives:

(1) To ensure realization of the design level of safety and reliability of the equipment;

(2) To restore safety and reliability to their design levels when deterioration has occurred;

(3) To obtain the information necessary for design improvements of those items whose design reliability proves inadequate; and

(4) To accomplish these goals at a minimum total cost, including maintenance costs and the costs of residual failures.

(b) Reliability-based maintenance programs are based on the following general principles. A failure is an unsatisfactory condition. There are two types of failures: functional and potential. Functional failures are usually reported by operating crews. Conversely, maintenance crews usually discover potential failures. A potential failure is an identifiable physical condition, which indicates that a functional failure is imminent. The consequences of a functional failure determine the priority of a maintenance effort. These consequences fall into the following general categories:

(1) Safety consequences, involving possible loss of the equipment and its occupants;

(2) Operational consequences, which involve an indirect economic loss as well as the direct cost of repair;

(3) Non-operational consequences, which involve only the direct cost of repair; or

(4) Hidden failure consequences, which involve exposure to a possible multiple failure as a result of the undetected failure of a hidden function.

(c) In a reliability-based maintenance program, scheduled maintenance is required for any item whose loss of function or mode of failure could have safety consequences. If preventative tasks cannot reduce the risk of such failures to an acceptable level, the item requires redesign to alter its failure consequences. Scheduled maintenance is also required for any item whose functional failure will not be evident to the operating crew, and therefore reported for corrective action. In all other cases the consequences of failure are economic, and maintenance tasks directed at preventing such failures must be justified on economic grounds. All failure consequences, including economic consequences, are established by the design characteristics of the equipment and can be altered only by basic changes in the design. Safety consequences can, in nearly all cases, be reduced to economic consequences by the use of redundancy. Hidden functions can usually be made evident by instrumentation or other design features. The feasibility and cost effectiveness of scheduled maintenance depend on the inspectablility of the component, and the cost of corrective maintenance depends on its failure modes and design reliability.

(d) The design reliability of equipment or components will only be achieved with an effective maintenance program. This level of reliability is established by the design of each component and the manufacturing processes that produced it. Scheduled maintenance can ensure that design reliability of each component is achieved, but maintenance alone cannot yield a level of reliability beyond the design reliability.

(e) When a maintenance program is developed, it includes tasks that satisfy the criteria for both applicability and effectiveness. The applicability of a task is determined by the characteristics of the component or equipment to be maintained. The effectiveness is stated in terms of the consequences that the task is designed to prevent. The basics types of tasks that are performed by maintenance personnel are each applicable under a unique set of conditions. Tasks may be directed at preventing functional failures or preventing a failure event consisting of the sequential occurrence of two or more independent failures which may have consequences that would not be produced by any of the failures occurring separately. The task types include:

(1) Inspections of an item to find and correct any potential failures;

(2) Rework/remanufacture/overhaul of an item at or before some specified time or age limit;

(3) Discard of an item (or parts of it) at or before some specified life limit; and

(4) Failure finding inspections of a hidden-function item to find and correct functional failures that have already occurred but were not evident to the operating crew.

(b) Components or systems in a reliability-based maintenance program may be defined as simple or complex. A simple component or system is one that is subject to only one or a very few failure modes. This type of component or system frequently shows decreasing reliability with increasing operating age. An age/time limit may be used to reduce the overall failure rate of simple components or systems. Here, safe-life limits, fail-safe designs, or damage tolerance-based residual life calculations may be imposed on a single component or system to play a crucial role in controlling critical failures. Complex components or systems are ones whose functional failure may result from many different failure modes and show little or no decrease in overall reliability with increasing age unless there is a dominant failure mode. Therefore, age limits imposed on complex components or systems have little or no effect on their overall failure rates.

(g) When planning the maintenance of a component or system to protect the safety and operating capability of the equipment, a number of items must be considered in the reliability assessment process:

(1) The consequences of each type of functional failure;

(2) The visibility of a functional failure to the operating crew (evidence that a failure has occurred);

(3) The visibility of reduced resistance to failure (evidence that a failure is imminent);

(4) The age-reliability characteristics of each item;

(5) The economic tradeoff between the cost of scheduled maintenance and the benefits to be derived from it;

(6) A multiple failure, resulting from a sequence of independent failures, may have consequences that would not be caused by any one of the individual failures alone. These consequences are taken into account in the definition of the failure consequences for the first failure; and

(7) A default strategy governs decision making in the absence of full information or agreement. This strategy provides for conservative initial decisions, to be revised on the basis of information derived from operating experience.

(h) A successful reliability-based maintenance program must be dynamic. Any prior-to-service program is based on limited information. As such, the operating organization must be prepared to collect and respond to real data throughout the operating life of the equipment. Management of the

ongoing maintenance program requires an organized information system for surveillance and analysis of the performance of each item under actual operating conditions. This information is needed to determine the refinements and modifications to be made in the initial maintenance program (including the adjustment of task intervals) and to determine the need for product improvement. The information derived from operating experience may be considered to have the following hierarchy of importance in the reliability-based maintenance program:

(1) Failures that could affect operating safety;

(2) Failures that have operational consequences;

(3) The failure modes of units removed as a result of failures;

(4) The general condition of unfailed parts in units that have failed; and

(5) The general condition of serviceable units inspected as samples.

(i) At the time an initial maintenance program is developed, information is usually available to determine the tasks necessary to protect safety and operating capability. However, the information required to determine optimum task intervals and the applicability of age or life limits can be obtained only from age or life exploration after the equipment enters service. With any new equipment there is always the possibility of unanticipated failure modes. The first occurrence of any serious unanticipated failure should immediately set into motion the following improvement cycle:

(1) An inspection task is developed to prevent recurrences while the item is being redesigned;

(2) The operating fleet is modified to incorporate the redesigned part; and

(3) After the modification has proved successful, the special inspection task is eliminated from the maintenance program.

(j) Component improvements based on identification of the actual reliability characteristics of each item through age or life exploration, is part of the normal development cycle of all complex equipment.

Issued in Washington, D.C., on April 30, 1999.

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[FR Doc. 99–11333 Filed 5–10–99; 8:45 am]

BILLING CODE 4910–06–P